

CHEMICAL CONTROL of WEEDS in NEW YORK VINEYARDS

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Cover Photograph

This photograph was taken in November 1957 in a Concord vineyard of Mr. Ross Summerson, Himrod, N. Y. One application of six pounds of Karmex per acre was made in April 1957. There was no other weed control practice in the sprayed area. The row on the left was, by accident, not sprayed with the herbicide; the row on the right is typical of the control in the sprayed rows.

With the low amount of ground cover in the sprayed area, less than six pounds of Karmex would be necessary for control in the next growing season.

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The major advantage of using chemicals as a substitute for mechanical control of weeds in vineyards is the reduction in cost.

The extent to which weeds must be controlled has not been precisely determined. However, in an experiment with Concord grapes, a three-ton yield was produced when the only tillage was disking, compared with a four-ton yield when disking was combined with mechanical removal of weeds from between the vines. This experiment was conducted in Fredonia, New York, over a period of eight years.

Yield differences resulting from method of removal were less than this. Tentatively, we consider that weeds are controlled if 70 percent of the area is bare and weed height is less than two feet in early October.

Experiments with two chemical control programs were conducted primarily with the Concord variety. Further observations and experiments indicate that mature vines of the major varieties in New York vineyards respond in a manner similar to that of the Concord.

Caution against use of 2,4-D

The use of 2,4,5-T and present commercial forms of 2,4-D near the vineyard is dangerous and should be avoided

TWO CHEMICAL CONTROL PROGRAMS AVAILABLE

Selective Soil Sterilants

Selective soil sterilants have been used as surface sprays since 1953 in mature vineyards in Fredonia, New York. These nearly insoluble materials, applied at the rate of 40 pounds per acre, kill almost all weeds but also injure grapes. At the recommended rates of two to six pounds per acre, they kill weeds selectively. At these low rates they do not move deeply into the soil, and do not accumulate because of decomposition by soil micro-organisms.

Moisture movement places selective soil sterilants such as Karmex in the top few inches where roots can absorb it. Plants most susceptible to the toxic action are shallow rooted; resistant plants are deep rooted. Therefore, young vines and layers are more readily injured than mature vines.

When these materials have been applied in April to weedy vineyards of mature Concord on gravelly loam at rates of 12 or less pounds per acre, they have not reduced vine growth, yield, or fruit quality.¹ This is evidence that the recommended rates, with a maximum of six pounds per acre, are not harmful to the vineyard.

The first visual symptom on grape vines of excessive Karmex is the loss of the normal green coloration from small areas of exposed, and mature leaves. Areas adjacent to leaf veins first show this creamy whiteness, as in magnesium deficiency. With excessive Telvar, interveinal tissue is first affected.

These symptoms are usually first seen in August or September and become more noticeable in October.

Contact Weedkillers

Contact weedkillers are toxic only to the parts of plants actually moistened by them. Aromatic oils and dinitros are the contact herbicides used since 1949 in some New York vineyards. Concord grape growth and production were increased when these contact weedkillers were used from 1946 to 1957. This oil-dinitro program requires more precise timing, three applications, and has a shorter residual action than do selective soil sterilants. It is toxic to all weed leaves and the application rate is the same for all soil types.

¹Analyses were made in the Department of Food Science and Technology, New York Agricultural Experiment Station; grape residues by Dr. A. W. Avens; grape quality by Dr. Willard Robinson.

Telvar is more soluble and of shorter residual action than Karmex. *With the exception that Telvar has clearance on grapes for only 4 lbs. per acre actually sprayed*, it may be used with essentially equal results wherever Karmex is mentioned in this bulletin.

RECOMMENDED MATERIALS

Selective Soil Sterilants

Karmex² and Telvar³ are recommended selective soil sterilants. Both of these materials are wettable powders and are practically insoluble in water. Vigorous agitation in the sprayer tank is required to keep them in suspension.

These materials should not be used on vines under four years of age. Although they will not prevent sucker development, actual spray contact with the green shoots will reduce growth.

Certain weeds are readily killed by these root-absorbed materials. Others demonstrate varying resistance depending on rooting depth.

Weeds Readily Controlled

Chick weed
Spring germinating annuals
Rye grass
Orchard grass
Most other common perennial grasses

Weeds Difficult to Control by April Applications at Legal Rates

Crab grass
Barnyard grass
Smart weed

²Karmex here refers to Karmex Diuron Weed Killer which is 80% 3-(3,4-dichlorophenyl)-1,1-dimethylurea. Prior to 1959 it was known as Karmex DW.

³Telvar here refers to Telvar Monuron Weed Killer, which is 80% 3-(p-chlorophenyl)-1,1-dimethylurea. Prior to 1959 it was known as CMU and Karmex W.

Horse nettle
Dock
Goldenrod
Wild carrot
Dandelion
Plantain
Milkweed
Bindweed
Morning glory

Bindweed and morning glory are not affected by rates of Karmex legal for vineyard use. Therefore, this herbicide is not useful in vineyards where these weeds are prevalent. Between 1956 and 1958 experiments in control of bindweed and morning glory were conducted in New York vineyards. These may result in commercial trials of the best treatments in 1960.

Contact Herbicides

Contact herbicides are aromatic oil⁴ and dinitro as an emulsion with water. An oil of this type is Agronol A. Suitable dinitros are formulations containing 50 to 60 percent dinitro secondary butyl phenol. Vigorous agitation is required to keep these materials properly mixed. This spray should not be applied to vines under four years of age nor to leaves, shoots or suckers that you wish to save.

A combination of contact herbicides and selective soil sterilants may be used where Karmex will be inadequate. With many perennial weeds,

⁴The specifications for the aromatic oil are: gravity, A.P.I., 20-25, flash, 180°-220° F, Saybolt viscosity at 100°F 35-45, aniline point 90-100, distillation (ASTM) I.B.P. 400°F, F.B.P. 700°F.

the addition of Karmex to the first oil-dinitro spray will improve control. This combination should not be used, for economic reasons if a Karmex program will provide control.

TIME OF APPLICATION

Karmex

A single annual application immediately after tying in April is suggested for Karmex. In vineyards with no green weeds in the sprayed area in April, the application may be delayed until May or early June.

Oil-dinitro

The first application should be made after weeds start, but before they attain a height of six inches. Repeat the application as weeds again approach six inches (early May, late May, and mid-June). Where desirable, add Karmex to the first oil-dinitro spray.

METHOD OF APPLICATION

Spray in a 30-inch band directly under the trellis. A wider band is unnecessarily expensive and a narrower band may result in a fringe of weeds between the disced and sprayed areas.

RATE PER ACRE OF LAND ACTUALLY SPRAYED

Rates apply to acres of land actually sprayed, not to acres of vineyard. To illustrate this difference, when spraying a 30-inch band, *one acre* actually

sprayed involves two and seven-tenths acres of grapes with seven foot rows, three and a half acres of grapes with nine foot rows, and four and three-tenths acres of grapes with eleven foot rows.

OIL-DINITRO AND COMBINATION

The rate per acre with oil-dinitro is not so critical. The primary objective is to wet the weeds. However, the same calibration procedure and gallonage as for Karmex is suggested. The oil-dinitro-water emulsion consists of:

Aromatic oil	10 gal.
Dinitro	1 qt.
Water	90 gal.

If a combination spray is to be used, the selected amount of Karmex (table I) should be added to the mixture above and applied with the same precision as Karmex alone.

MIXING MATERIALS

Fill the sprayer tank with water to a level at which the agitation assembly is well covered. With the agitator running, slowly add the proper amount of herbicide and the desired quantity of water. Do not add Karmex to an empty sprayer tank.

CALIBRATION OF SPRAYER

To apply the desired amount of Karmex, it is necessary to calibrate the equipment so that a *known quantity of liquid* can be sprayed over *one*

TABLE 1.
**Rates of Karmex for Various Soil Textures,
Weed Populations, and Weed Susceptibility**

Soil Texture	Percentage of ground covered with <i>readily-controlled</i> weeds at time of spraying			Percentage of ground covered with <i>difficult to control</i> weeds at time of spraying		
	10%	50%	80%	10%	50%	80%
Pounds of Karmex per acre actually sprayed						
Gravelly or sandy loam	3	4	5	5	6*	**
Silt or clay loam	4	5	6*	6*	**	**

*Karmex is labeled for use at rates up to 6 lbs.

**Under these conditions 6 lbs. of Karmex has been inadequate.

TABLE 2.
**Nozzle* tip size, pressure and speed
to deliver 200 gallons per acre actually sprayed
in a 30-inch band with nozzles set 18 inches above the ground**

Nozzle* tip size	Pressure (lbs. per sq. in.)	Rate of travel (mph)
6504	63	2.0
6506	41	2.5
6506	63	3.0

*Teejet nozzles were used in our trials

TABLE 3.
**Pounds of Karmex to Add
to Various Amounts of Water After Calibrating
to Deliver 200 Gallons Per Acre Actually Sprayed**

Desired pounds of Karmex per acre actually sprayed	50 gal.	100 gal.	200 gal.
2	$\frac{1}{2}$ lb.	1 lb.	2 lb.
3	$\frac{3}{4}$	$1\frac{1}{2}$	3
4	1	2	4
5	$1\frac{1}{4}$	$2\frac{1}{2}$	5
6	$1\frac{1}{2}$	3	6

acre of land made up of 30-inch bands under the trellis. Two hundred gallons per acre actually sprayed has proven to be a satisfactory quantity. Table 2 gives you the information needed for calibrating your equipment to deliver this amount. Use plain water when calibrating your equipment. Vineyard and/or weed conditions may require that the nozzles be higher. If so, angle the nozzle tips to cover a 30-inch band.

TO CHECK CALIBRATION

Operating at the selected settings you should collect one quart of liquid from one nozzle while traversing a distance of 87 feet. If you do not, check nozzles and adjust pressure or speed slightly until you do collect one quart over the measured distance.

HERBICIDE COST FOR ONE ACRE OF VINEYARD

Materials to spray a 30-inch band in a vineyard with nine foot rows at the rate of six lbs. of Karmex per acre actually sprayed cost approximately \$6.00. The oil-dinitro cost for this same situation is about \$3.00 per application.

Recent studies of grape production costs in Chautauqua County indicate that the labor involved in chemical weed control is approximately one-third that for mechanical weed control in this 30-inch area under the trellis.

EQUIPMENT

Satisfactory weed control without injury requires accurate application of the correct quantity of chemical. This can be accomplished by using the equipment described below.

Power Sprayer: A sprayer used only for applying vineyard herbicides may be the most satisfactory. However, a sprayer used for insecticide applications can be used since *all the presently recommended vineyard weed spray materials can be washed out of the equipment.* See section on cleaning the sprayer for details.

Pump: The pump may be either a power-take-off mounted, low pressure type or a high pressure piston type. If a high pressure pump (as on a regular vineyard spray rig) is used, an additional supplementary pressure regulator is needed to permit accurate control at low pressures. If other than a piston type pump is used, it is suggested that it have a minimum rated capacity of 12 to 15 gallons per minute at 50 lbs. pressure.

Tank: The tank, of metal or wood, can be of the trailer type or directly mounted to the tractor. Sizes in common usage are 50 gallon, 100 gallon, and 200 gallon tanks. One hundred gallon and larger tanks are normally of the trailing type.

Agitation: Vigorous, constant agitation is necessary if accurate applications are to be made. Mechanical agitation is generally preferred (paddles or a propeller on a shaft) and is usually satisfactory.

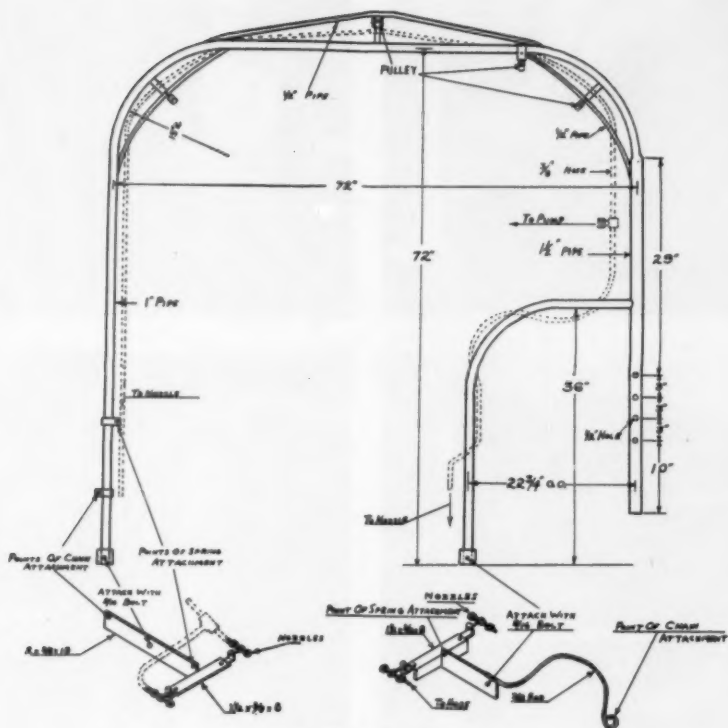


Figure 1

Diagram of vineyard weed-spray boom. The 1½-inch pipe shown on the extreme right of this diagram extends 48 inches to the indicated reduction to the 1-inch pipe used in the top and left portions of the boom. The base of this 1½-inch pipe is attached within the 2-inch pipe mount shown in Figures 2 and 3.

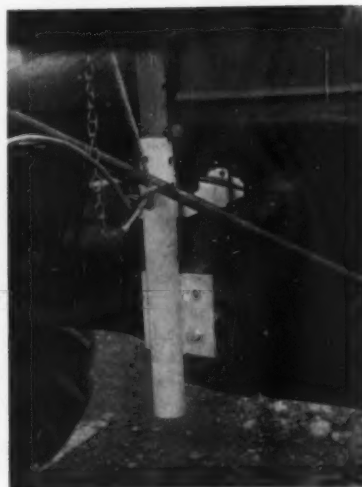
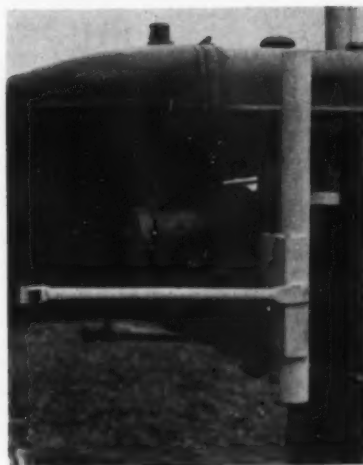
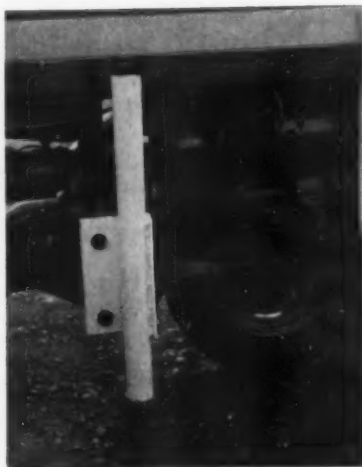


Figure 2

Attachment of the 2-inch-pipe mount to four makes of vineyard tractors.

Hydraulic agitation has proved satisfactory in Wilmington, Delaware experiments by L. E. Creasy and C. E. Wilson and under field conditions in 1958, where the spray tank was not larger than a 55 gallon drum. Hydraulic agitation requires the placing of jets on the end of a liquid return line to the tank. This return line *should not be* the regular by-pass line, but a separate agitation line which should be located between the pressure regulator and the boom shut-off valve. Jet sizes which are satisfactory for a 55 gallon drum are "Whirl jet,"⁵ number 2 caps or their equivalent. For Karmex agitation three jet caps should be mounted on the end of the agitation line about a half inch from the inside bottom of the tank to obtain a high velocity sweep of the bottom of the tank in three horizontal directions. This agitator assembly should be connected to a pipe rather than a hose, so that it can be held in a firm position inside the tank. For oil-dinitro agitation, arrange the jet caps so that the oil does not separate and rise to the surface of the spray mixture. Jet agitation, as just described, depends upon having adequate spray volume available in excess of spray boom requirements. At the recommended pressures for vineyard weed spray applications, the agitator assembly will require from three to four and a half gallons per

minute in excess of boom requirements of two to four and four-tenths gallons per minute. Therefore, the suggested minimum low pressure pump capacity is 12 to 15 gallons per minute at 50 pounds pressure.

Spray Boom: An over-the-row boom that can be mounted on the tractor enables the operator to spray a single row from both sides simultaneously. This permits accurate placement and uniform coverage of a strip directly under the trellis. See figure 1 for the boom design⁶. Note that the spray liquid does not actually travel through the boom, but through hoses that are attached to the boom. Low pressure plastic hose of three-eighths to one-half inch in diameter is satisfactory for the nozzle lines. It is suggested that the discharge line to the boom be one-half to five-eighths inch. Figures 2 and 3 show the mounting and position of the boom.

Pressure Regulator: A low-pressure pressure regulator is essential. A diaphragm type regulator will permit more accurate control of pressure than other types.

Pressure Gauge: A gauge that is accurate in the range of 0 to 100 pounds pressure should be placed in the line where it is readily visible to the operator.

⁵"Whirl Jet" caps used as jets in agitation studies and "Tee Jet" nozzles used in weed control studies.

⁶Figure 1 is presented for growers who wish to make a boom. This boom is now manufactured commercially as Yellow Devil.

Shut-Off Valve: Place a positive, quick acting shut-off valve between the pressure regulator and the nozzles so that spraying can be stopped at the ends of rows or in the vineyard without stopping agitation.

Spray Nozzles: Four nozzles are the standard number and are adequate for many situations. Under varying weed and soil conditions, however, it is desirable to vary the rate per acre according to need. This may be accomplished by putting two separate spray lines on the boom, each with its own shut-off valve. Put four nozzles on one spray line (two on each side of the row) and two nozzles on the second line (one on each side of the row). In this way three different rates of application can be obtained by operating two, four or six nozzles. With this arrangement calibrate your equipment to deliver 200 gallons per acre with four nozzles spraying, and select your Karmex rate on the basis of the average weed control problem. Then with only two nozzles operating, you can apply approximately 60 percent of your calibrated rate, and with six nozzles operating you can apply approximately 130 percent of your calibrated rate. The spray nozzles should deliver a flat spray pattern at an angle of 65 to 70 degrees through an orifice of 0.04 to 0.06 inches. Adjust the nozzles so that the spray pattern is perpendicular to the 30-inch band. The exact nozzle tip size needed can be determined from table 2.

Screens: A large capacity line strainer or screen of 50 mesh or coarser (for example 40 mesh) is a must with Karmex. With clean equipment and good line screens, nozzle screens are usually not needed.

Speedometer: The speedometer should register in miles per hour and is essential if you are to maintain a constant rate of ground travel over uneven topography.

CLEANING THE SPRAYER

If a spray rig used to apply the herbicides discussed in this bulletin *is also* to be used for insecticide or fungicide applications, it must be washed out thoroughly or injury may occur to the sprayed plants. The oil and dinitro wash out readily, but Karmex is more difficult. If Karmex has been used, flush the tank and lines with water *immediately* after completing the herbicide application before Karmex particles have a chance to settle and lodge in the rust flaking in the pipe lines and tank. Then fill the tank about half full of clean water, agitate vigorously, and pump out. Repeat at least three times, being sure to clean screens and all places where Karmex might settle and become lodged. Clean the sprayer in an area where the wash water will not injure valuable plants.



Photo by C. V. Flagg

Figure 3

The vineyard weed-spray boom mounted on the tractor in position for operation.



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